Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–III • EXAMINATION – SUMMER 2013

Subject Code: X30604 **Date: 17-05-2013**

Subject Name: Advanced Fluid Mechanics

Time: 02.30 pm - 05.00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain hydrodynamically smooth and rough pipe.	**07**
	(b)	Explain "flow net". Write its uses and limitations.	**07**
Q.2	**(a)**	Obtain equation of continuity for three dimensional flows by Cartesian co-ordinates.	**07**
	(b)	The velocity in x. y and z directions are given by u = 2x – yt, v = y – zt and w = x – 3z + t respectively. Determine the acceleration and velocity at point (1 , 1, 2) and t = 1.	**07**
		OR	
	(b)	Discuss the specific energy curve with a neat sketch.	**07**
Q.3	**(a)**	Defines the term stream function. How it differs by potential function.	**07**
	(b)	In a two dimensional incompressible flow, the fluid velocity components are given by U = x – 4y and V = -y – 4x. Show that velocity potential exists and determine its form. Find also the stream function.	**07**
		OR	
Q.3	**(a)**	Obtain equation of continuity for the fluid flow in polar co- ordinate.	**07**
	(b)	In a two dimensional flow of compressible fluid, the tangential component of velocity $V\alpha=\frac{C\sin\alpha}{r^2}$, where C is constant. Using equation of continuity, determine the expression for radial velocity V. Also find the magnitude and direction of resultant velocity.	**07**
Q.4	**(a)**	Explain Hardy cross method.	**07**
	(b)	Describe various types of hydraulic models.	**07**
		OR	
Q.4	**(a)**	Describe Rayleigh method for dimensional analysis.	**07**
	(b)	Explain and prove Buckingham's π – theorem.	**07**
Q.5	**(a)**	Explain the concept of boundary layer. Derive the expression for displacement thickness.	**07**
	(b)	Describe Reynold's experiment and discuss the laminar and turbulent flow in pipe.	**07**
		OR	
Q.5	**(a)**	Explain formation of boundary layer with neat sketch and also explain separation of boundary layer.	**07**
	(b)	Explain Prandtle's mixing length theory.	**07**

****

Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC SEM-III Examination May 2012

Subject code: X30604

Subject Name: Advanced Fluid Mechanics

Date: 17/05/2012 **Time: 10.30 am – 01.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Derive an expression for most economical section for a rectangular shaped open channel section. **07**

(b) Explain and Prove Buckingham's π – Theorem. **07**

Q.2 **(a)** Derive an expression for gradually varied flow and state the assumptions made in it. **07**

(b) Derive an expression for the velocity distribution for viscous flow through circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe. **07**

OR

(b) Explain Hardy Cross method of analysis of flow in pipe net works. **07**

Q.3 **(a)** (i) Derive and explain Euler's Equation of motion. **04**

(ii) Find the velocity and rate of flow of water through a rectangular channel of 6m wide and 3m deep, when it is running full. Bed slope 1 in 2000.Take C=55. **03**

(b) Explain Prandtle's mixing length theory. **07**

OR

Q.3 **(a)** If the velocity distribution in boundary layer is given by u/U= y/δ, determine the displacement thickness, momentum thickness and energy thickness. **07**

(b) Determine the maximum discharge of water through a circular channel of diameter 1.5m. When the bed slope of channel is 1 in 1100. Take C=60. **07**

Q.4 **(a)** Describe the Rayleish method for dimensional analysis. **07**

(b) Define "Dimensional Homogeneity" and test whether following equations are dimensionally homogeneous or not. **07**

(i) $v = \frac{1}{n} R^{\frac{2}{3}} S^{\frac{1}{2}}$ (ii) $h_f = \frac{flv^2}{2gD}$ (iii) $Q = 3.33LH^{\frac{3}{2}}$

OR

Q.4 **(a)** Derive the relation for laminar flow between two parallel plates the mean velocity is equal to two-third of the maximum velocity. **07**

Q.4 **(b)** Describe Reynold's experiment and discuss the laminar and turbulent flow in pipe. **07**

Q.5 **(a)** Obtain an equation of continuity for three dimensional flow. **07**

(b) Explain formation of boundary layer with sketch and also explain separation of boundary layer. **07**

OR

Q.5 **(a)** Discuss the classification of channel slopes. **07**

(b) Discuss the specific energy curve with a neat sketch. **07**

****

Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

P.D.D.C. Sem- III Examination December 2010

Subject code: X30604

Subject Name: Advance Fluid Mechanics

Date: 16 /12 /2010 **Time: 10.30 am – 01.00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain Buckingham π theorem method	**07**
	(b)	Derive the expression for the velocity distribution for viscous flow through circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe.	**07**
Q.2	**(a)**	Obtain an equation of continuity for three dimensional flow.	**07**
	(b)	Derive an Equation of Gradually varied flow, and write assumption made in it.	**07**
		OR	
	(b)	Explain separation of boundary layer.	**07**
Q.3	**(a)**	Expiain formation of boundary layer with sketch.	**07**
	(b)	In a two dimensional fluid flow the component of the velocity along the x-axis is given $U = 3x-2x^2y+y^3$. Determine the component of the velocity along the y-axis for the Condition of continuity of flow.	**07**
		OR	
Q.3	**(a)**	Explain Hydrodynamically smooth and rough pipe.	**07**
	(b)	Determine the length of back water curve caused by an afflux of 1.5 m in a rectangular channel at width 45 m and depth 2.0 m. The slope of the bed is given as 1 in 2000. Take meaning's N = 0.03.	**07**
Q.4	**(a)**	Discuss the classification of channel slopes	**07**
	(b)	Laminar flow of an oil with maximum velocity at 5.6 m/sec in a 30 cm diameter pipe. If dynamic viscosity of an oil is 0.18 kg sec/m. Calculate shear stress at pipe wall and within fluid 6.0 cm from the pipe wall.	**07**
		OR	
Q.4	**(a)**	Explain Hardy cross method	**07**
	(b)	A model of spillway is made to test the flow. The discharge and velocity of flow over the model were measured as 2.5 m /sec and 1.5 m/s. Find the discharge and velocity over prototype which is 50 times larger them it's model.	**07**
Q.5	**(a)**	Discus the specific energy curve with a neat sketch	**07**
	(b)	In a two dimensional incompressible flow, the fluid velocity components are given by $U = x - 4y$ and $V = - y – 4x$ .Show that velocity potential exists and determine its form. Find also the stream function.	**07**
		OR	
Q.5	**(a)**	Explain Prandtle's mixing length theory	**07**
	(b)	Find the expression for the drag force on smooth sphere of diameter D, moving with a uniform velocity V in a fluid of density ρ and dynamic viscosity μ	**07**

****